Driggs, Lucas, Brubaker & Hogg Co., L.P.A
Attorneys - at - Law
8522 East Avenue
Mentor, Ohio 44060

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Per our conversation, please find attached the 3 references you requested.

Re: Serial # 10/083,067

1920

Chapter 7

340
212
128 °F

CHAPTER SEVEN

THE SPHEROIDAL CONDITION OF LIQUIDS. – WHY THE HAND MAY BE DIPPED IN MOLTEN METALS. – PRINCIPLES OF HEAT-RESISTANCE PUT TO PRACTICAL USES: ALDINI, 1829. – IN EARLY FIRE-FIGHTING. TEMPERATURES THE BODY CAN ENDURE.

THE spheroidal condition of liquids was discovered by Leidenfrost, but M. Boutigny was the first to give this singular subject careful investigation. From time out of mind the test of letting a drop of water fall on the face of a hot flat-iron has been employed to discover whether it may safely be used. Everybody knows that if it is not too hot the water will spread over the surface and evaporate; but if it is too hot, the water will glance off without wetting the iron, and if this drop be allowed to fall on the hand it will be found that it is still cool. The fact is that the water never

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touches the hot iron at all, provided the heat is sufficiently intense, but assumes a slightly elliptical shape and is supported by a cushion of vapor. If, instead of a flat-iron, we use a concave metal disk about the size and shape of a watch crystal, some very interesting results may be obtained. If the temperature of the disk is at, or slightly above, the boiling point, water dropped on it from a medicine dropper will boil; but if the disk is heated to 340° F., the drop practically retains its roundness – becoming only slightly oblate – and does not boil. In fact the temperature never rises above 206° F., since the vapor is so rapidly evaporated from the surface of the drop that it forms the cushion just mentioned. By a careful manipulation of the dropper, the disk may be filled with water which, notwithstanding the intense heat, never reaches the boiling point. On the other hand, if boiling water be dropped on the superheated disk its temperature will immediately be *reduced* to six degrees below the boiling point; thus the hot metal really cools the water.

By taking advantage of the fact that different

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liquids assume a spheroidal form at widely different temperatures, one may obtain some startling results. For example, liquid sulphurous acid is so volatile as to have a temperature of only 13° F. when in that state, or 19° below the freezing point of water, so that if a little water be dropped into the acid, it will immediately freeze and the pellet of ice may be dropped into the hand from the still red-hot disk. Even mercury can be frozen in this way by a combination of chemicals.

Through the action of this principle it is possible to dip the hand for a short time into melted lead, or even into melted copper, the moisture of the skin supplying a vapor which prevents direct contact with the molten metal; no more than an endurable degree of heat reaches the hand while the moisture lasts, although the temperature of the fusing copper is 1996°. The natural moisture of the hand is usually sufficient for this result, but it is better to wipe the hand with a damp towel.

In David A. Wells' *Things not Generally Known*, New York, 1857, I find a translation of an article by M. Boutigny in *The Comptes*

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Rendus, in which he notes that "the portion of the hands which are not immersed in the fused metal, but are exposed to the action of the heat radiated from its surface, experience a painful sensation of heat." He adds that when the hand was dampened with ether "there was no sensation of heat, but, on the contrary, an agreeable feeling of coolness."

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Abstract Submitted
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Disk model of the dynamic Leidenfrost phenomenon

MARTIN REIN, DLR - Institut für Strömungsmechanik, Göttingen, FRG — The interaction between a droplet and a hot solid surface is considered. When the temperature of the surface is above a critical value (the so-called Leidenfrost point T_L) a droplet which is carefully placed on the surface is floating on its own vapor. Similarly, when the droplet approaches the surface with a non-zero velocity the vapor production can be so high that the droplet is reflected without wetting the surface. This happens for temperatures above a dynamic Leidenfrost point $T_{DL} > T_L$. We will model this process by approximating the droplet by a liquid disk. The flow of the vapor in the gap between the approaching droplet and the surface is considered to be incompressible and inviscid. Thus, the inertia of both the droplet and the vapor are of primary importance. Heat transfer is considered to be by conduction and radiation, respectively. The disk model describes the main features of the dynamic Leidenfrost effect. In particular, due to a redistribution of energy the velocity of the reflected droplet is reduced. This phenomenon which is also observed in experiments, has previously been attributed to viscous dissipation in the flow in the liquid droplet. The minimum gap height depends on the velocity and mass of the droplet and on the surface temperature in a correct manner. Furthermore, the temperature drop in the hot surface is calculated and found to agree qualitatively with experimental results of other authors.

Martin Rein
rein@dv.go.dlr.de
DLR - Institut für Strömungsmechanik

[X] Prefer Oral Session
[ ] Prefer Poster Session

Date submitted: 5 Aug 1996

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